Performance Verification of Animal Waste Treatment Technologies Through the U.S. Environmental Protection Agency's Environmental Technology Verification Program

Ray M. Frederick[1], Thomas G. Stevens[2], Maren H.J. Roush[2], John J. Classen[3], Frank J. Humenik[3], C. Mike Williams[3]

[1]U.S. Environmental Protection Agency, Edison, NJ; [2]NSF International, Ann Arbor, MI
[3]North Carolina State University, Raleigh, NC

Abstract

The U.S. Environmental Protection Agency (EPA) created the Environmental Technology Verification (ETV) Program to further environmental protection by accelerating the commercialization of new and innovative technology through independent performance verification and dissemination of high-quality data. The ETV program works in partnership with recognized testing organizations and stakeholder groups representing buyers, vendor organizations, consulting engineers, and academic researchers and with federal state and local governments. NSF International, in cooperation with the EPA , manages the ETV program's Water Quality Protection Center (WQPC), and collaborated with North Carolina State University's Animal And Poultry Waste Management Center to conduct performance verification tests on three solids separator technologies consisting of two inclined screens and a centrifuge designed for swine waste treatment. Swine production has received heightened attention both in North Carolina and nationally because of the industry's growth and the associated problems of waste management. Several problems related to treating solids in swine waste include the increased organic load placed on the treatment system, requiring larger overall capacities and lower usable volume because of the settled solids accumulating on the bottom of the lagoon or treatment vessel. Efficient solids separation has been a desired part of a total waste management system not only for reducing system operating problems, but for reclaiming the nutrient-rich manure solids for beneficial use. Although these systems can reduce the amount of suspended solids entering treatment, they require time and attention to keep them operating properly and may be a factor in the appropriate selection of technology for this purpose. Performance verification testing was conducted at NCSU's Lake Wheeler Road Field Laboratory, which is a farm designed and operated as a research and testing facility. Analytical parameters assessed during the verification tests included: total, volatile, and suspended solids; total organic carbon; total kjeldahl nitrogen (TKN); ammonia nitrogen; total and ortho-phosphorus; potassium; chloride; copper; zinc; nitrogen/phosphorus/potassium (NPK) ratio; pH, and; conductivity.

Verified Technologies:

Inclined Screen with worm screw/perforated cylinder (Brome Agri Sales Ltd.)
Centrifuge (Triton Systems, LLC)
Inclined Screen and clarifier (Hoffland Environmental, Inc.)

Brome Agri Sales, LTD

Triton Systems, LLC

Hoffland Environmental, Inc

Test Plan:

Tests conducted at North Carolina State University, Animal and Poultry Waste Management Center
Mass balance of solids
Twelve days of testing over 4 weeks
Power measurements
Operational notes and problems

Target Parameters:

Total, volatile and suspended solids
NPK ratio
Total organic carbon
Conductivity
Chloride, Copper, Zinc
Total Coliform, E. coli
Vender requested parameters

Results:

System A:
28% solids recovery
7.4% total nitrogen recovery
12% total phosphorus recovery
Simple technology, <1.5kW

System B:
55% solids recovery
20% total nitrogen recovery
42% total phosphorus recovery
More complex technology with O&M requirements, <20kW

System C:
9.7% solids recovery
5.2% total nitrogen recovery
5.6% total phosphorus recovery
Simple technology, <1.5kW